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10/559,142	12/01/2005	Moon-kyoon Chun	NEK-0015	9045

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EXAMINER
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LISTVOYB, GREGORY

ART UNIT	PAPER NUMBER
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1796

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01/09/2008

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

**Office Action Summary**

Application No.

10/559,142

Applicant(s)

CHUN ET AL.

Examiner

Gregory Listvoyb

Art Unit

1796

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 05 June 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-24 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-24 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-3, 5-8, 10, 12-13, and 23-24 rejected under 35 U.S.C. 103(a) as being unpatentable over Oshida et al (JP publication 06-056921) herein Oshida in combination with Kurokawa (JP publication 2001-329021), herein Kurokawa.

Oshida discloses a method for manufacturing imide-substituted polymer comprising the following steps:

1. Reaction of 60-90%wt of aromatic vinyl monomer (for example, Styrene, lines 0007 and 0009) and 10-40 % wt of unsaturated dicarboxylic anhydride (for instance, maleic, line 0009, meeting newly added limitation of Claim 1) in methyl ethyl ketone at the presence of 0.011% wt initiator (line 0021) at 150C.

Regarding newly added limitation of Claim 1, Oshida discloses that the feeding ratio between vinyl and carboxylic acid monomers is less than 5:1 (see line 0021) based on their weight. Considering that MW of the monomers (MW of Maleic Anhydride is 98, MW of Styrene is 104 and MW of Methylmethacrylate is 102) are close, the

corresponding molar ratio is less than 6:1, meeting the newly added limitation of Claim 1.

2. Separation step performed by supplying the polymerized solution discharged from the step (1) into a separator and then removing unreacted monomers and solvent at 200C and 50 Torr (line 0022).

3. Reaction of continuously supplying melt from step (2) into imidization reactor, containing Aniline (line 0023)

4. Drying step to remove volatiles.

In reference to a newly added limitation about total residence time of 2-5 hours, Oshida and the Application disclose the same imidization reaction. However, since Oshida's discloses a continuous process, compare to The Application's batch one, Oshida does not disclose a residence time of a reaction.

It would have been obvious to a person of ordinary skills of the art to set a reaction time in order to achieve predetermined conversion of the monomer. Typically, residence time for continuous process is much lower compare to batched one.

In reference to new Claim 24, Oshida discloses weight average molecular weight of 135000 (see Table 1). Note that not Applicant nor Oshida disclose proper determination of MW by GPC, since GPC is a relative method and GPC standards are

not disclose (see Spec page 31 and Oshida line 0033). By using PS standards with one detector only relative MW numbers can be obtained. Considering the above arguments and the fact that typically MW numbers obtained in different labs differ by up to 20%, MW of 135000 (Oshida) and 140700 (Application) are indistinguishable for an artisan.

Oshida does not teach that imidization reaction (step 3) takes place at the presence of catalyst.

Kurokawa discloses a multi step method for production of imidized polymer, where imidization step takes place in Metylisobutyl ketone at the presence of triethylamine (Example 1). The catalyst increases the rate of imidization

Therefore, it would have been obvious to a person of ordinary skills in the art to use a solvent and a catalyst in imidization, since catalyst increases the rate of imidization.

Claims 1, 4, 9, 11 and 14-23 rejected under 35 U.S.C. 103(a) as being unpatentable over Kurokawa in combination with Oshida.

Kurosawa discloses a multi step method for production of imidized polymer, where imidization step takes place in Methyilisobutyl ketone at the presence of triethylamine (Example 1).

Regarding claim 4, Kurosawa discloses 0.001-1%wt of initiator, which is of 1,1 bis (tert-butyl-peroxy) cyclohexane.

Regarding Claim 9, Kurokawa teaches 60 % wt of Metylisobutyl ketone in the first reaction step.

In reference to claim 11, reaction temperature in the reactor gradually increases from 85 to 140C (Example 1).

In reference to Claim 14, the molar ratio between maleic anhydride and aniline is within the range of 0.1-0.9 (Example 1).

In reference to claims 15 and 16 the ratio of triethylamine to aniline is 3/97 (Example 1)

Regarding claim 18 and 19, imidization takes place at 140C (Example 1) and devolatilization occurs at 310C and 30 torr (Example 1).

In reference to Claim 20, conversion of unsaturated carboxylic acid is 95% or more (Line 005).

In reference to claim 22, MWD of the final polymer is between 2 and 3, which is close to theoretical MWD. It suggests that the polymer is unimodal styrene-maleinate copolymer. In contrast, in case of forming vinyl-based homopolymer, the resulting MWD would be significantly broader than 3.0.

In reference to claim 21, since the Kurokawa's reaction conditions are similar to one in the application, Kurokawa's process completes at the same time as one in the Application.

Kurokawa does not teach a separation step between polymerization and imidization.

Oshida teaches the above separation step. Separation of unreacted monomer and solvent is economically beneficial, since they can be returned into the first step of the process without any additional separation.

Therefore, it would have been obvious to a person of ordinary skills in the art to include a separation step between polymerization in Kurokawa's process, since it provides economically sound process due to recycling unreacted monomer and solvent.

### ***Response to Arguments***

Applicant's arguments filed on 6/05/2007 have been fully considered but they are not persuasive.

Regarding Applicant's argument that "Oshida is silent as to the composition ranges of vinyl monomers and imidized monomers in the imidized polymer after polymerization and imidization", Oshida discloses the polymer having aromatic vinyl monomer content of 60-90 wt% and unsaturated dicarboxylic anhydride content of 10-40 wt% (see line 0009).

Applicant's argument that "Amended Claim 1 includes a molar ratio of aromatic vinyl monomers to unsaturated dicarboxylic anhydride monomers of 0.67-6.0:1, as polymerized. Neither Oshida nor Kurokawa discloses this" is incorrect.

Oshida discloses that the feeding ratio between vinyl and carboxylic acid monomers is less than 5:1 (see line 0021) on their weight. Considering that MW of the monomers (MW of Maleic Anhydride is 98, MW of Styrene is 104 and MW of Methylmethacrylate is 102) are close, the corresponding molar ratio is less than 6:1, meeting the newly added limitation of Claim 1.

Regarding the newly added limitation the Applicant states that by using a relatively short (2.0-5.0 hour) reaction time in the copolymerization step as disclosed, polystyrene formation, which occurs after the unsaturated dicarboxylic anhydride monomers having higher reactivity relative to the aromatic vinyl monomer are fully consumed, can thereby be prevented in advance. However, typically for continuous processes of Oshida and

Kurokawa, the residence time should be much lower compare to the Application's batch process.

***Conclusion***

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gregory Listvoyb whose telephone number is (571) 272-6105. The examiner can normally be reached on 10am-7pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vasu Jagannathan can be reached on (571) 272-1119. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Gregory Listvoyb  
Examiner  
Art Unit 1796

GL  
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RABON SERGENT  
PRIMARY EXAMINER

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